# THE ESO EXISTS TO

- Ensure reliable, secure system operation to deliver electricity when customers need it
- Transform participation in smart and sustainable markets
- Unlock consumer value through competition
- Drive towards a sustainable, whole energy future

ESO

The challenge: the energy system is changing

achieving **net zero**

requires an **integrated energy system**

operating an **integrated energy system**

requires modelling a wide **range of scenarios**

modelling a wide **range of scenarios**

requires **visibility of system behaviour**

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For power system expertise

The challenge: the energy system is changing

data sharing

requires a **common social-technical framework** to facilitate interoperability
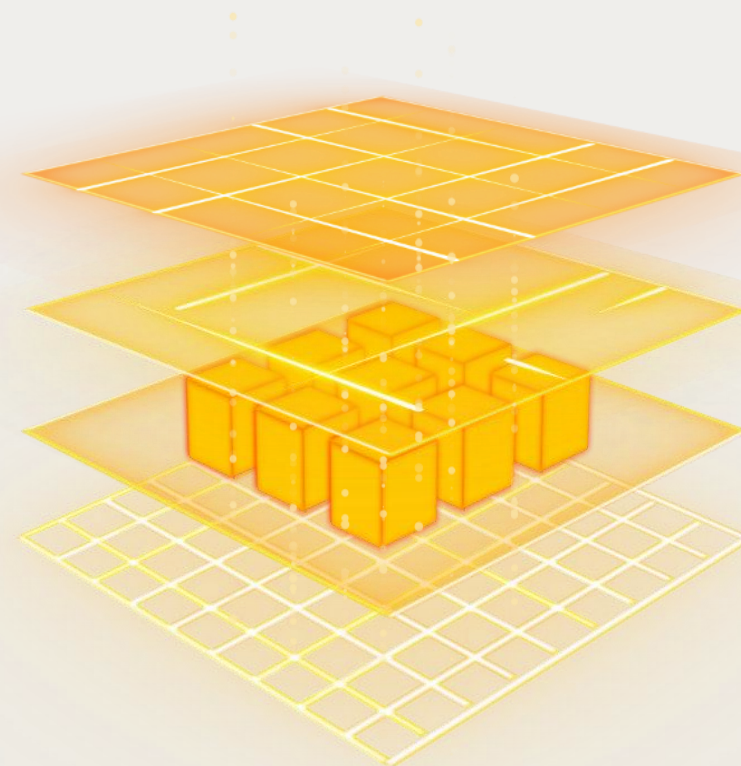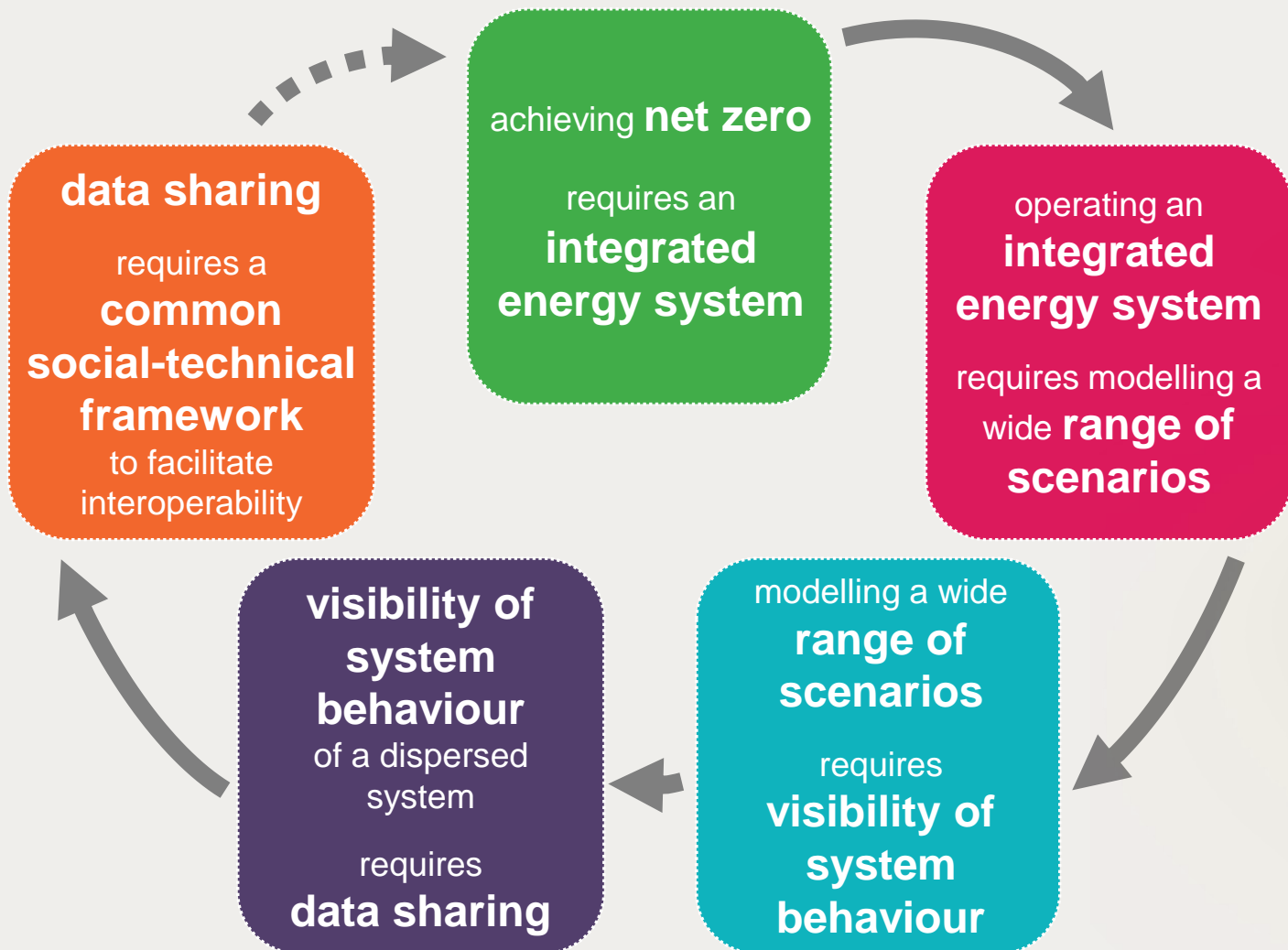
achieving **net zero**

requires an **integrated energy system**

operating an **integrated energy system**

requires modelling a wide **range of scenarios**

visibility of system behaviour of a dispersed system

requires **data sharing**

modelling a wide **range of scenarios**

requires **visibility of system behaviour**

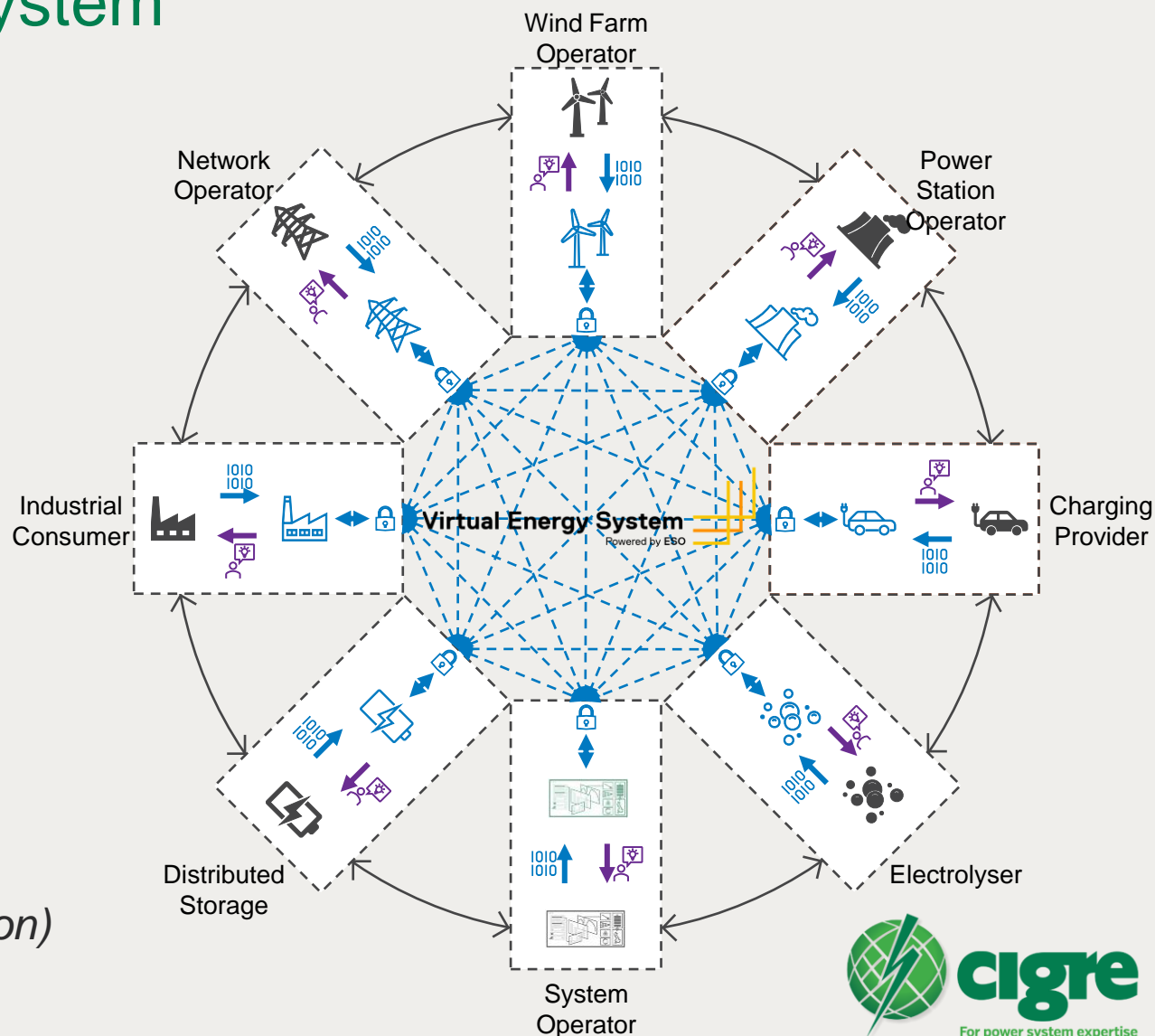ESO

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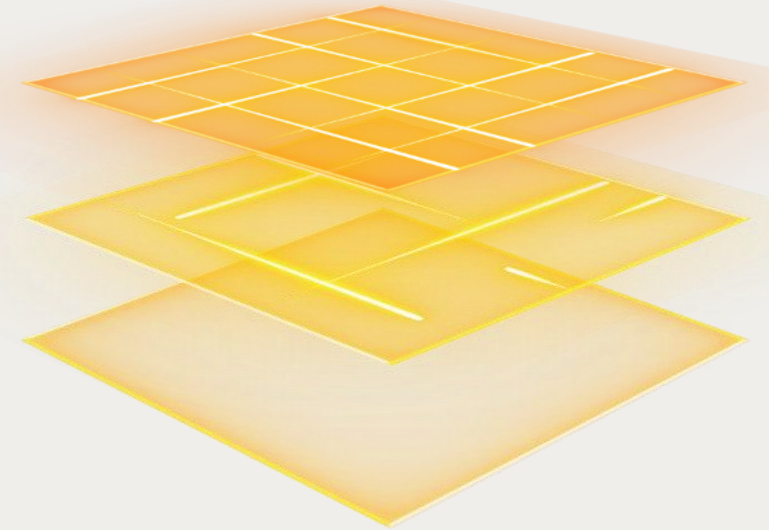
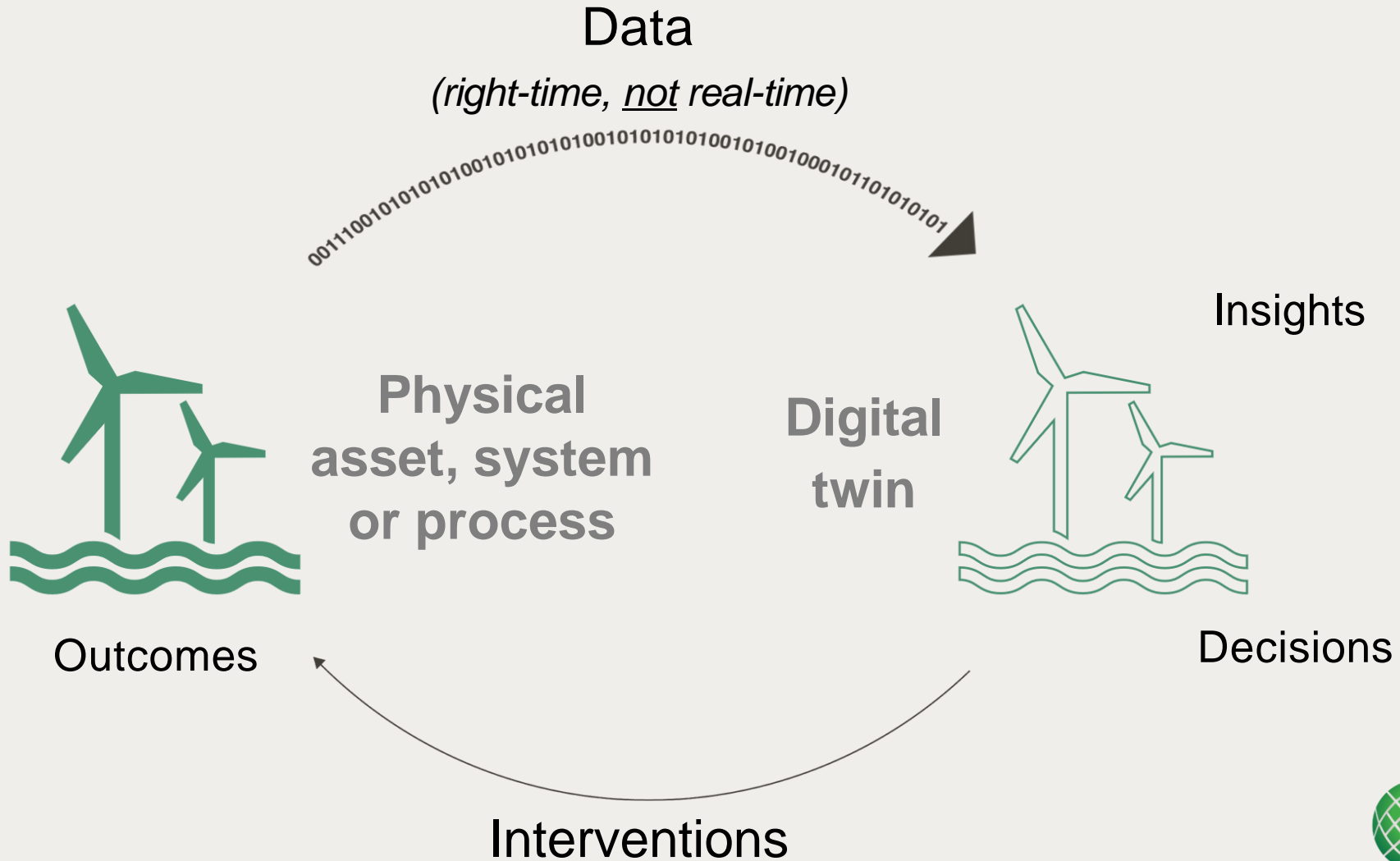# The solution: Virtual Energy System

Ambitious objective:

Enable the development of an ecosystem of **connected digital twins**

For the **entire GB energy system** to solve wider system challenges

(e.g. energy optimisation, carbon reporting, investment planning, …net zero energy transition)

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An ecosystem of connected digital twins

Data

(right-time, <u>not</u> real-time)

Physical asset, system or process

Digital twin

Insights

Outcomes

Decisions

Interventions

ESO

An ecosystem of connected digital twins

Physical connection

Physical asset, system or process

Digital twin

Digital connection

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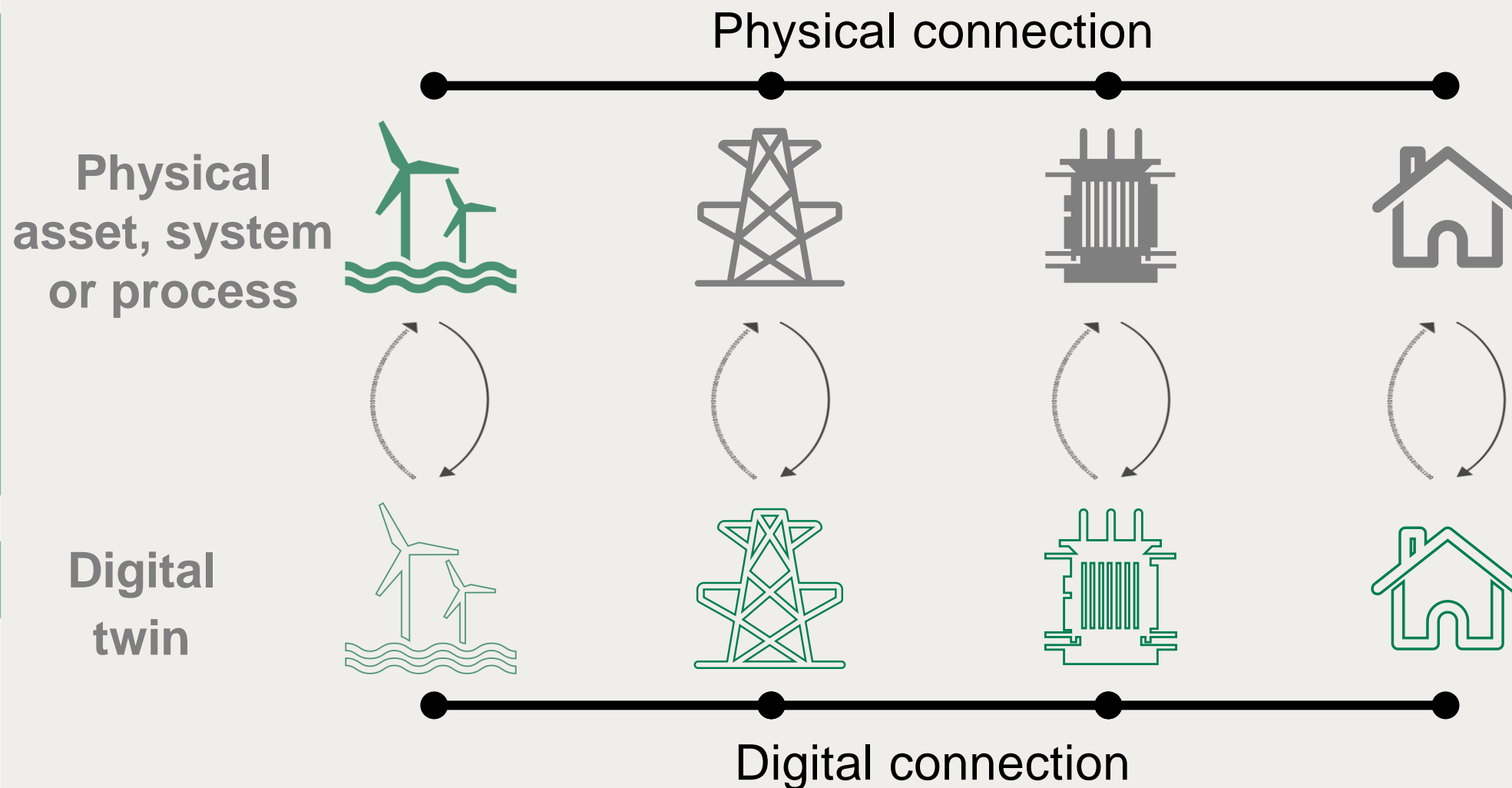
What needs to happen: common framework

People	Defining roles & responsibilities	Raising awareness & fostering culture	Building capabilities & skills	
Process	Aligning around industry codes & standards	Engaging stakeholders	Creating a governance framework	Determining the operating environment
Data	Aligning models & taxonomies	Establishing management & governance	Increasing visibility & enabling sharing	Managing security
Technology	Connecting physical infrastructure	Enhancing modelling and analysis	Creating an interoperable 'tech-stack'	

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Demonstrator use case

Transmission

Distribution

GSP A

GSP B

Switch (default open)

Renewables | Storage | Demand | Renewables | Storage | Demand
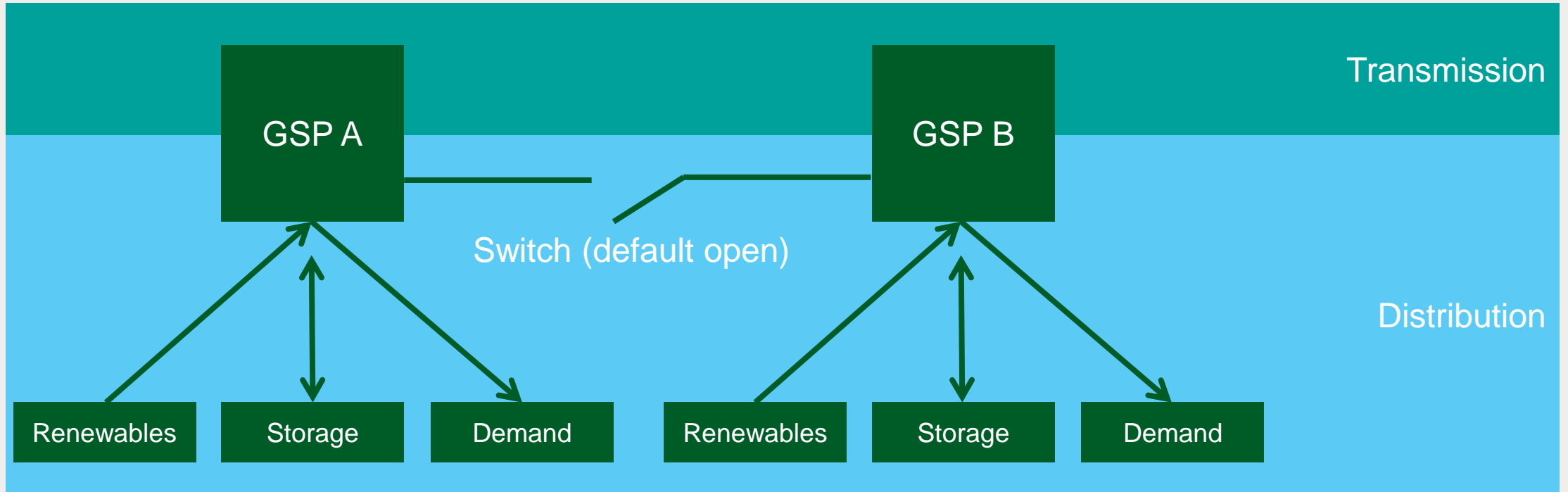
Example GSP configuration (GSPs can be owned by the TO or the DNO)

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User journey

1 – Prepare & 2 – Publish

Task Lead: Data Provider
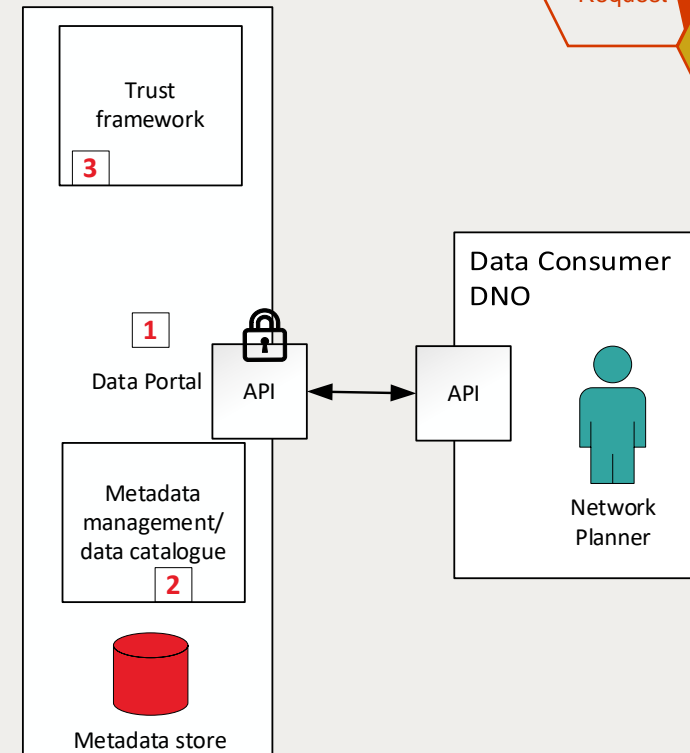
#	Activity	Importance
1	Data is standardised into agreed sector format	Enables interoperability across sector both legal and technical, considering common language & standards
2	Metadata is populated	Enables search, discovery and understanding of the data
3	Data is security tagged	Enables secure sharing of data with the correct consumers
4	Data schema is validated	Checks that the data being shared conforms to agreed standards
5	Data is published using APIs	Ensures that the data is securely shared using approved protocols

Virtual Energy System hexagon diagram: 1. Prepare, 2. Publish, 3. Search & Find, 4. Request Access, 5. Review Request, 6. Provide Access

Data Producer DNO process flow: Network Planner → DNO's standard data → **1** Data standardisation → VirtualES standardised data → **2** Metadata entry → **3** Security tagging → **4** Schema validation → **5** API

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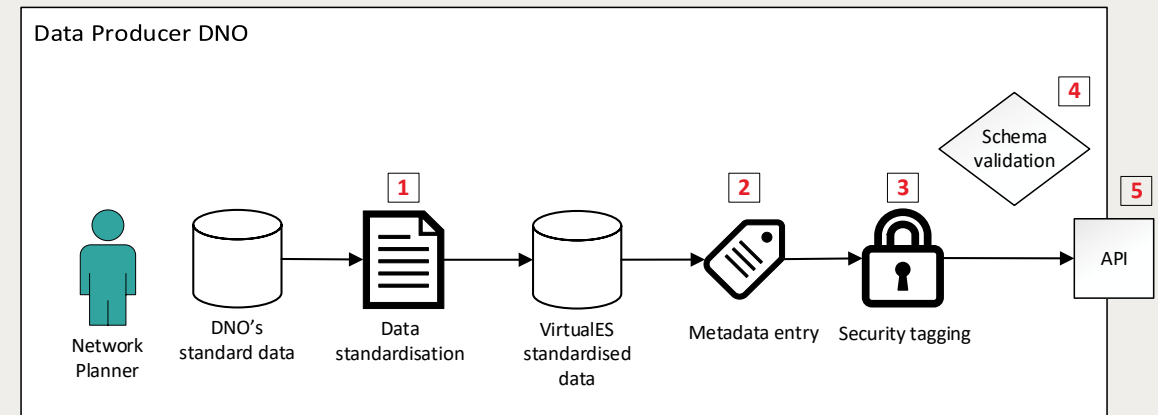
3 – Search & 4 – Request access

Task Lead: Data Consumer

| #	Activity	Importance
1	Consumer accesses data portal	Front entrance/user interface for the VirtualES that can be accessed as a web link.
2	Data is searched using a data catalogue	Search and discovery relevant data using search filters and metadata.
3	Access to data is requested using a trust framework 1. Consumer is pre-approved 2. Consumer not pre-approved and must request access	Provides the mechanism to enable sharing by ensuring permission policies are met

5 – Review request & 6 – Provide access

Task Lead: Data Provider

#	Activity	Importance
1	Producer is notified of access request	Producer can see who is requesting access and why
2	Data is streamed using a distributed streaming service	Data is streamed in 'right-time' using a performant streaming technology
3	Security & governance controls are applied	Security, governance and other policies are applied to the data
4	Data is accessed using APIs	Data is securely accessed using approved protocols

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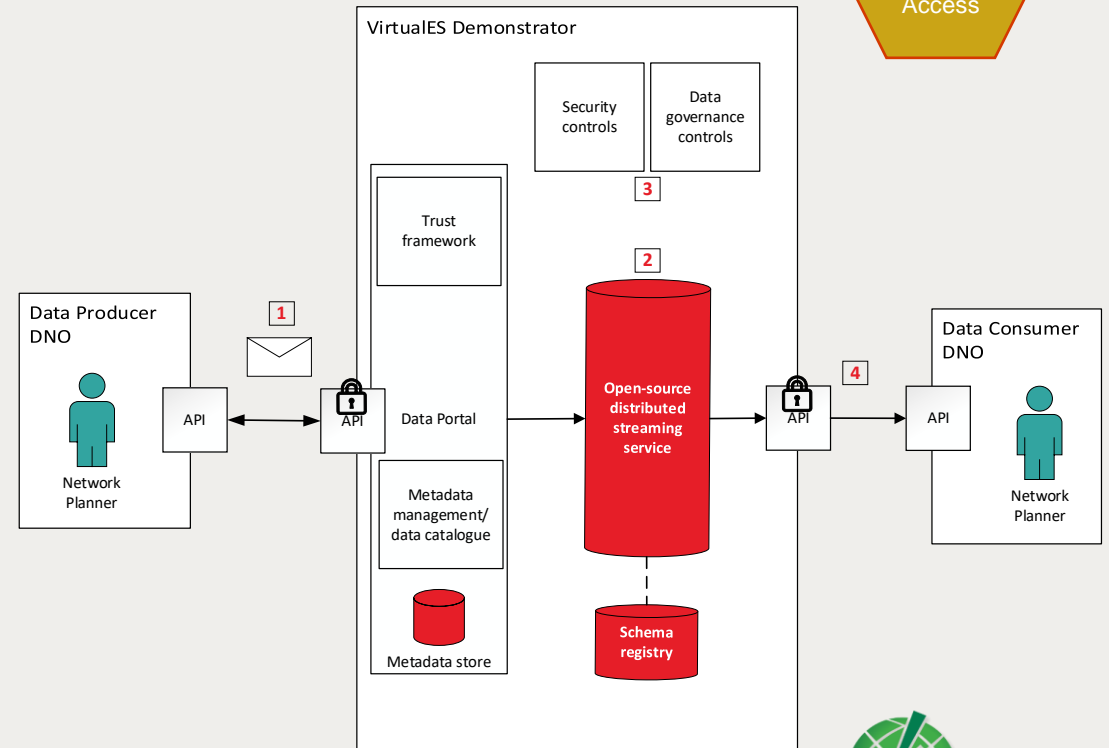
High level design
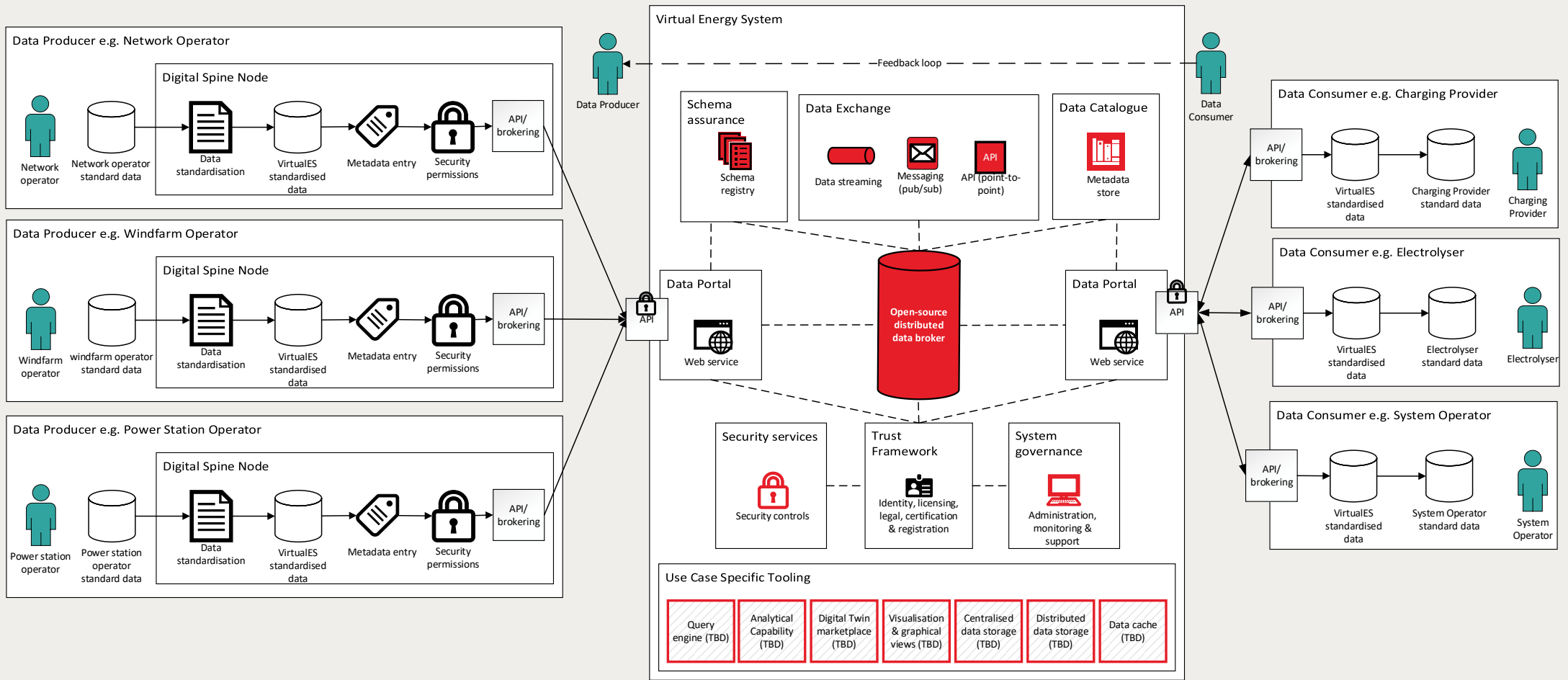
Role of standardisation and conformance

- Common Grid Model Exchange Standards (CGMES) 3.0 : Latest version of ENTSO-e's adoption of CIM 17 from IEC standards

- GB CIM : Ofgem adoption of CGMES 3.0 with extensions for consideration into distribution networks long term planning

  [ofgem.gov.uk – Outputs from the Long Term Development Statement Reforms Working Group – July 2023]

- GC0139 : Enhanced planning data exchange to facilitate whole system planning

  [nationalgrideso.com – Industry Info – Codes – Grid Code – Grid Code Modifications]

- Energy Digitalisation Taskforce recommended increasing use across electricity and a CIM-like implementation for gas networks

  [es.catapult.org.uk – Energy Digitalisation Taskforce]

- Data Best Practice promotes and requires pursuit of interoperability

  [ofgem.gov.uk – Decision on updates to Data Best Practice Guidance – August 2023]

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Future Energy –> Virtual Energy System

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